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Herbarium collections policy of the Finnish Museum of Natural History

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Abstract

The herbarium collections are sub-collections of the Finnish Museum of Natural History Luomus that manages national natural history collections, as referred to in the Universities Act. The general collections policy defines the overall principles and guidelines concerning the collections practices. The sub-collections policies specify its guidelines and instructions, considering the special nature of the sub-collections. The policy for the botanical and mycological herbarium collections guides the activities related to all botanical, mycological and phycological collections in herbaria, hence excluding digital collections, DNA and tissue samples as well as living collections, which have separate policies. The herbarium collections policy defines and outlines the purpose of the collections as is to accrue and preserve natural specimens representing biodiversity for research and university-level teaching. The policy defines the objectives and content of related activities, the division of responsibilities for the administration and care of the collections within the organisation, and the general principles and practices for the acquisition, preservation, availability and use of the collections.

Keywords

accessioning, algae, best practices, bryophytes, collections management, deaccessioning, fungi, herbarium, lichens, natural history collections, vascular plants

1. Status and implementation of the collections policy

The collections policy of the Finnish Museum of Natural History (Luomus) is hierarchically structured. The General Collections Policy (Hyvärinen et al. 2020) defines the overall principles and guidelines. The sub-collections policies, i.e., separate collection policy documents, comply with, and apply the general collections policy and specify its guidelines and instructions, taking the special nature of the sub-collections into account. The collections policy for the botanical and mycological herbarium collections is one of these separate policy documents and guides the activities related to all botanical, mycological and phycological collections, excluding DNA and tissue samples as well as living collections, which have separate policies. In this document, the collections policy for the botanical and mycological collections will hereafter be referred to as the 'collections policy'. The collections policy was prepared at Luomus by the Botany Unit, discussed by the collections steering group and approved by the management group on 10 January 2019. As a rule, the implementation of the collections policy is the responsibility of the Vascular Plants Team, which administer the vascular plant and phycological collections, as well as of the Mycology and Bryology Team, which administer mycological and bryological collections and each employee and visiting researcher using the collections administered by Luomus.

Goals of the collections policy

The goal of the collections policy is to ensure the high scientific quality of the collections and related information as well as physical and digital access to the collections for the purposes of scientific research.

The policy defines and outlines the purpose of the collections, the objectives and content of related activities, the division of responsibilities for the administration and care of the collections within the organisation, and the general principles and practices for the acquisition, preservation, availability and use of the collections. Related specific approaches and processes are described separately in the instructions of each team (e.g., Museum/University wiki).

Definition of a collection

A collection is a group of organised specimens and closely connected information, from which the specimens can be accessed based on either saved collection data or the location of the specimens. Specimens not yet in the condition required for incorporation in a collection and not recorded as having been accessioned are not considered as part of the collection.

The datasets (e.g., specimen databases) included in a collection are stored and organised together with material not included in the collection (e.g., observation files). The Digital Data policy (unpubl.) of Luomus is also applied to all such data.

Purpose of the collections

The primary purpose of the collections is to accrue and preserve natural specimens representing biodiversity for research and university-level teaching. The specimens are also used at the Luomus public attractions, thus serving the purposes of environmental education and the needs of educational institutions. The collection specimens document the structural and genetic diversity of plant and fungal species as well as their distribution. The collections promote knowledge of the world's plant and fungal species, understanding of the evolution of species, and appreciation for biodiversity. They are part of a global network of natural science collections, which constitutes a key resource for biodiversity research and is part of the infrastructure shared by the national and international research communities that has been built over centuries and must be preserved for future generations.

Legislation, general principles and strategic guidelines pertaining to the Luomus collections are discussed in the general collections policy. The botanical and mycological collections are part of the Luomus national natural history collections, as referred to in the Universities Act (2009). The maintenance of the collections contributes to the implementation of the Luomus mission of being “responsible for the preservation, accumulation and exhibition of the national natural history collections and for research and education relating to them”.

Collection responsibilities in the Botany Unit

The director of the Botany Unit has overall responsibility for the Luomus botanical and mycological collections, including preservation, acquisition, documentation and use. Responsibilities related to the collections are divided between the Vascular Plants Team and the Mycology and Bryology Team. The team leaders are responsible for the collections administered by their teams. The responsibilities of the teams are shared by the scientific staff (curators, senior curators/professors) so that each collection has a scientific collection coordinator and, if necessary, a deputy coordinator. Practical responsibilities for the care of the collections and the supervision of work are agreed by each team, and this division of responsibilities is documented in the guidelines for the care of the collections.

2. Principles for collection acquisitions

Accessioned material

The collections are supplemented systematically based on the objectives for the collections policy and the research policy, not haphazardly. Acquisitions focus on research strengths, threatened or rare species as well as type specimens. The scientific value of the strengths is enhanced by supplementing the collections and deaccessioning deficient material.

Acquisition efforts are guided by the potential information content of specimens and their utility for research. The content may be related to the documentation of species-level diversity (systematics and taxonomy), of intraspecific variation and of distribution history or species distribution, for instance. Active and high-quality collections-oriented research provides the primary basis for acquisitions. The collections grow with specimens obtained from the work performed by the Luomus staff and with donations received from other researchers, students, authorities and private individuals. In addition, collections can be expanded through exchanges with other equivalent collections units or through purchases. As a rule, all material associated with research and theses completed at Luomus must be offered for inclusion in the collections together with appropriate documentation, but the collection coordinator decides whether to accept such material.

At a general level, accessioned specimens are prioritised as follows:

1. Scientifically valuable and technically high-quality specimens that support the Luomus strengths and are important for current and emerging research
2. Specimens that supplement existing valuable sets of collections and add to their coverage (e.g., by supplementing geographical or taxonomic coverage)
3. Specimens with no immediate research value that can serve other societal interests, such as the objectives of environmental education or the presentation of biodiversity

Specimens can also be accessioned if they constitute a consistent resource together with the collections of museums other than Luomus.

Collection strengths and responsibilities

The following strengths guide the expansion of the botanical and mycological collections:

- Groups of organisms actively investigated at Luomus. In the 2010s, these focus areas determined by active research included lichenised fungi, the Aphyllophorales and bryophytes and, in the group of vascular plants, pteridophytes as well as the families Asteraceae, Chenopodiaceae and Cyperaceae.
- Certain geographical areas such as Eastern Fennoscandia and the boreal zone in general, North and South America, Central and East Asia as well as sub-Saharan Africa (University of Helsinki research focus area)

Other responsibilities that guide the expansion of the collections include the following:

- Type specimens
- Threatened and rare Finnish species
- Documentation of the distribution of plants and fungi in Finland and neighbouring areas
- Documentation of research results with specimens
- Documentation of the collections of the Kumpula and Kaisaniemi botanic gardens (voucher specimens)

Quality criteria for specimens

The quality criteria for the specimens and specimen data listed in the general collections policy guide the development of the collections. These criteria are applied when expanding and deaccessioning collections (disposing of specimens) to enhance the standards of the collection content. Quality criteria for the botanical and mycological collections:

- Reliability and accuracy of the information on specimen collection
- Technical quality of the specimens
- Sufficient level of taxonomic determination (e.g., genus or group)
- Special historical values

Ethics and legality

The collections are expanded in line with principles and practices for the protection and promotion of our planet's biodiversity. Specimens must be collected in accordance with the laws and provisions of the countries of origin, Finnish legislation and the international conventions Finland has ratified (e.g., CITES 1973, Nagoya Protocol 2010). When accessioning new specimens, the required information on the permissibility of the specimens and their terms of use is entered into the collection management system Kotka (Heikkinen et al. 2019). Those providing specimens may be required to supply written documentation on the origin and terms of use of the specimens.

National division of work

The botanical and mycological collections of Luomus are part of the Finnish natural history collections. The definition of the strengths of these collections requires knowledge and recognition of the strengths of collections at other institutions so that the expansion of various collections can be guided and directed to increase the value of individual collections and, at the same time, rationalise the division of work. Other herbaria may, for example, focus on specific geographical areas in Finland or elsewhere. For example, the herbarium of the University of Oulu focuses on northern Finland, while that of the University of Turku focuses on the Neotropics.

3. Receipt and accessioning of specimens

Accessioning and cataloguing

Individual new specimens do not become part of a collection until they are catalogued. When accessioning a new specimen, its data are stored in Kotka CMS (or in the case of vascular plants during the transition period, in Kastikka database), and the specimen is assigned a unique identifier. Material previously organised in collections belong to them even if that material has not yet been digitally stored. The cataloguing or digitisation of such material does not constitute the expansion of collections.

New specimen batches or private collections offered to and received by Luomus can be entered into Kotka CMS as separate metadata even before the potential accessioning of the specimens. This enables the monitoring of the resources offered.

Decision-making

The inclusion of a specimen or specimen batch in the collection is decided by the relevant collection coordinator or a person designated by them in accordance with written instructions. In the case of extensive collections, the Luomus director decides on their receipt based on a proposal by the unit director.

When accessioning specimens, general quality criteria must be applied in addition to those mentioned above:

- Scientific significance and documentary value
- Whether the specimens expand the content and coverage of the collections, or duplicate existing material
- The manner in which the specimens promote the strengths of Luomus as well as its collections policy and research policy objectives

The following must also be considered in relation to storage resources:

- The number of specimens and related facility requirements
- In the case of specimen groups requiring a great deal of space, additional criteria defined in the general collections policy

Terms attached to the receipt of specimens

As a rule, specimens or collections are not accepted if they come with terms other than those relating to collection permit practices. In the case of highly valuable material, Luomus and the donor can agree on a waiting period of up to two years from the date of transfer to the accessioning of the material and the opening of the material for free use. Such agreements are approved by the Luomus director at the proposal of the unit director.

4. Collection management

The availability and real utility value of collections depend on the systematic organising of the collections and the data documenting them as well as on the understanding of these practices. Collection management refers to this process of organising and documenting collections. Compliance with the principles of collection management is monitored, and related practices are developed in teams under the supervision of team leaders and collection coordinators and together with the Biodiversity Informatics Unit.

Metadata

Metadata about the structure of botanical and mycological collections document the division of the collections into sub-collections as well as the composition, scope and location of the collections. Such metadata are specified at a general level in Kotka CMS. The persons responsible for sub-collections are recorded in the system. Metadata are openly available to all.

Specimen details and collection management system

The details of individual specimens can be recorded on specimen labels, collecting documents and/or collection management systems and catalogues. Detailed information on the collecting and origin of all new specimens are recorded in Kotka CMS. The objective of collection management is the registration of the whole collection in Kotka CMS. Information to be registered in Kotka CMS also includes the use history and the physical consequences of use, such as damage caused by the preparation of microscope slides or the removal of material for DNA extracts.

Specimens must have clear labels including key information on their origin as well as an identifier that complies with uniform standards and links them to the collection management system. When replacing labels, the original labels and those with information that differs from the current information must be kept.

Registration of specimen-specific details

The most important required information on specimens relate to the place and time of collecting. Specimens without such information are usually not included in the collection.

At least the following information must be entered into the collection management system on new specimens to be accessioned (quality criterion):

- Sufficient taxonomic determination (e.g., up to genus and family levels)
- Site where found (country, area, coordinates and information on the coordinates used, georeferencing where possible)
- Exact date of collecting
- Collector and collecting identifier (if used)
- Type specimen status, if any, and related publication data to be added when the description has been published

Recommended additional information includes:

- Number (or estimated number) of individuals in the population
- Detailed description of the site where found
- Habitat (macro- and micro-habitat), culture medium, host organism (if any) and companion species
- Reference to collecting event (e.g., research project, excursion, expedition) and its metadata

- References to publications in which the specimen has been used as part of a dataset can also be added later

Physical organisation of collections

The herbarium of the Botany Unit are divided into botanical, lichenological, phycological, bryological and mycological collections. These sub-collections are further physically organised on a taxonomic and geographic basis. Certain historical resources are organised into separate collections. The findability of collections and specimens is paramount when organising them. The method of organising each collection is indicated in its metadata.

Botanical collections

Botanical collections are primarily located in the Kaisaniemi main building, the fluid-preserved collection is located in the facilities of the Natural History Museum, and the Herbarium Generale (general collection of plants other than those from the Fennoscandia region) is temporarily located on the L3 floor of the Topelia building.

The Fennoscandia collections and part of the monocotyledonous plants in the Herbarium Generale are kept in the main building. As for separate collections, the type specimens of vascular plants are placed in the Steven room (first floor), the algae collections on the third floor and the apomictic plants in rooms 110, 112, 119 and 214 of the main building. The separate collections stored in Topelia include the “boxed” collection as well as the collection of galls and feeding tracks.

Mycological collections

The mycological and lichenological collections are located on the second and third floors of the Kaisaniemi main building as well as in the intermediate facility between these floors ('2.5'). The collections are further divided into the Eastern Fennoscandia collections (Herbarium Fennoscandiae orientalis and Lichenes Fennoscandiae orientalis) and general collections (Fungi externi, Lichenes externi). The mycological collections are further divided into systematic groups. The separate E. Acharius and W. Nylander collections as well as the type specimen collections of fungi and lichens are located in the Acharius room on the second floor of the main building. Some undetermined material is kept in Topelia.

Bryological collections

The Luomus bryological collections are situated on the third floor of the Kaisaniemi main building. They include general collections (Herbarium generale) and the Eastern Fennoscandia collections (Herbarium Fennoscandiae orientalis) as well as the V. F. Brotherus and S. O. Lindberg bryophyte herbaria.

5. Collection maintenance

The care of collections follows international standards for the care of scientific collections. The aim is to ensure the preservation of specimens for use by the scientific community for centuries to come. This requires special methods relating to, for example, storage, pest control, specimen handling and the safety and security of collection facilities.

Collection facilities

Material that can jeopardise the safety and security of the collections or their related information is not stored in collection facilities. The instructions for collection care (Museum/University wiki) describe the processes for handling the material transferred to collections. Specimens are processed (drying, freezing, attaching/encasing, accessioning) in designated work facilities.

Care routines

Permanent technical collections staff monitor, care for, maintain collection specimens, and regularly supervise the conditions in collection facilities. Collections are maintained under the team leader's supervision in accordance with agreed practices. The possible occurrence of pest insects in collection facilities is continuously monitored. If larvae appear, the whole cabinet must be deep-frozen (-37°C for seven days) at the same time. Toxins (e.g., pyrethrin) are used for the treatment of empty cabinets only.

Safety and security

Safety and security coordinators have been designated for collection facilities. Staff have received orientation on the emergency plan, which is also readily available in written form. The University's occupational health and safety organisation monitors general occupational safety.

Responsibility for the acquisition of hazardous chemicals as well as the supervision of their storage has been assigned within teams to coordinators, who must ensure that related safety data sheets and laboratory work instructions are available to all. Hazardous volatile substances are processed in fume hoods. The above coordinators also ensure that personal protective equipment and clothing are available. The Horticulture Team is responsible for the transport of hazardous waste from the site.

Visitors working with collections also receive orientation relating to key safety and security instructions and work practices.

Definition and scientific evaluation of collections

The continuous scientific evaluation of collections by the staff as well as support (e.g., facilities and tools) for visiting researchers working with collections are key for their high-

quality maintenance. Staff organise the collections so that they are easily accessible and available to specialists.

Digitisation strategy

The usability of collections hinges on the digital availability of specimen images and data (section 6). The digitisation of type specimens, historically or scientifically significant sub-collections and of resources relating to the collection focus areas is given priority. The digitisation of specimens in use (particularly those to be sent for loan and those returned) is also prioritised over other collections.

6. Availability and use of collections

The collections are used primarily for scientific research and university-level teaching and secondarily for other teaching and environmental education.

Availability and user rights

The availability of collections is their key quality criterion and value indicator. The aims of the collections policy include making the collections available for effective use by the scientific community.

The use of the physical collections requires permission. The person who primarily decides on such permission is the relevant scientific collection coordinator, his or her deputy, a team leader or a unit director. The person granting the right to use the collection determines, on a case-by-case basis, the scientific significance of the use, the user's qualifications and the risks involved.

Openness of datasets

Metadata related to the collections and, as a rule, digitised specimen data in Kotka CMS are considered open data in accordance with the Luomus Digital Data Policy (unpubl.) and are available to the scientific community and the general public through the Finnish Biodiversity Information Facility (as a rule, CC Attribution 4.0 or more recent). With regard to sensitive species, the recommendations included in the list maintained by the Finnish Biodiversity Information Facility are followed concerning the accuracy of open data.

Access to collection facilities

Access to the collection facilities requires authorisation (access control). The team leader or person responsible for the relevant facility provide permission for access. Staff as well as those with a work contract with Luomus have free access to the collection facilities, whereas others can use the collections with guidance from the collection staff of the relevant team. Assistance of visitors is one of the core duties of the teams.

A record is kept of visitors working with collections. The person overseeing the visit also ensures that the visitor is familiar with appropriate procedures for handling scientific specimens. Visitors receive written instructions, and staff are informed about visitors through internal communications.

Requests to access collections are handled and considered without delay. The aim is also to duly provide the opportunity for a collection visit: visits lasting up to one working day within a two-week period and longer visits within a one-month period.

Specimen loans

Specimens included in the collections are available on loan to other collection units and research institutes subject to a decision by person responsible for the collection and in accordance with international practice. A written agreement on loans and their terms must always be concluded. The parties to such agreements are the institutes: the lender and the signatory must be in a permanent, responsible employment relationship with their organisations. Collection specimens are not usually lent/sent on loan to, or accepted on loan from, private individuals. If specimens are sent on loan to a private individual, the person responsible for the collection is technically the lender and is personally responsible for the loan.

Information on outgoing and incoming loans is stored in Kotka CMS. Specimens on loan must be handled carefully. The loan period is always defined in the agreement. By default, the loan period is 12 months and, in the case of type specimens, up to six months. In the case of type specimens, digital images are primarily offered. Loans must be extended by concluding an equivalent written agreement. The person responsible for the collection sends regular reminders on items past their due date.

Restrictions can be imposed on the loan of type specimens or other particularly valuable specimens. The aim is to promote the sending of digital images rather than the specimens themselves. As a rule, material to be sent on loan is digitised before sending it, and particularly valuable material, as mentioned above, must always be digitised first. If necessary, those submitting a loan request for type specimens are asked for an original reference to the species description as well as grounds for assuming the type specimen in question can be found at Luomus. The digital availability of collection specimens reduces the need to travel and to send specimens by post.

Destructive sampling

When borrowing museum specimens, it is assumed that the specimens will be returned in their original condition. A separate agreement is required to use a specimen for destructive sampling (e.g., for the preparation of a microscope slide), and both the original specimen and the preparations made must, as a rule, be returned.

Destructive sampling per se is carried out, for example, for preparing microscope slides of museum specimens or the use of material for DNA studies. Persons responsible for

collections can, at their discretion, give permission for destructive sampling based on authorisation from the unit director. The discretion is based on an assessment of the scientific significance of the sampling in relation to the scientific value of the complete specimen. To obtain permission, the person requesting it must sign a document outlining the terms of permission before the specimens can be sent. The basic principle of sampling is the minimisation of damage to collection specimens.

Tissue samples taken of collection specimens that have been handed over are formally processed as loans, similarly to the loans based on the separate Genomic Resources Collection Policy. The right of ownership to, and use of, DNA preparations remains with Luomus, unless otherwise agreed, and the lender reports on the use of specimens. The lender is responsible for ensuring or obtaining the right of use for purposes referred to in the Nagoya Protocol, and this is stated in the loan document.

Other use

The use of collections for exhibitions and the rental or loan of specimens to not just scientific research and collection units, but also to other parties are based on the guidelines of the general collections policy.

7. Deaccessioning of specimens

In accordance with the objectives of the collections policy, each specimen added to the collections is potentially important for their aims, that is, a relevant and usable documentation of biodiversity. This is not always the case with all material currently included in the collections. The quality of collections and the efficient use of facilities can be improved by de-accessioning, or disposing of, specimens. An alternative solution is to exchange specimens with other scientific collection units or to donate or sell specimens to such units.

Under the general collections policy, deaccessioning is based on the decision of the unit director. Decisions on the disposal of individual specimens are made by the person responsible for the collection together with, or with the authorisation of, a team leader or other supervisor.

The deaccessioning of a specimen can be considered in the following cases:

- The original information on the specimen is missing and cannot evidently be found. In exceptional cases, individual specimens in good condition that represent a taxon otherwise missing from the collection can remain in it.
- The specimen is in poor condition (deficient characteristics), and the collection includes a sufficient amount of equivalent material from the same area and period.
- There are a large number of specimens from the same site, but as the material is insufficiently documented, it cannot be justified as a population specimen.
- The specimens are duplicates.

When deaccessioning specimens, any reliable observation data are stored. This also applies to specimens in poor condition. If necessary, the material to be disposed of is digitised by scanning it.

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